RESTRICTED

Report No. PTR-83a

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

APPRAISAL OF

A FIRST HIGHWAY PROJECT

KOREA

June 9, 1971

Transportation Projects Department

Currency Equivalents:*

Currency Unit	=	Won (W)
US$1	=	W315
W1	=	US$0.0032
W1 million	=	US$3,174

*The exchange rate is floating, but the rate used in this report is indicated above.

Fiscal Year: January 1 - December 31

System of Weights and Measures: Metric

Metric		British/US Equivalent
1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 square kilometer (km^2)	=	0.386 square miles (sq mi)
1 kilogram (kg)	=	2.205 pounds (lbs)
1 metric ton (m ton)	=	0.98 long ton (lg ton)
	=	1.1 US short ton (sh ton)

Abbreviations and Acronyms:

BPR	=	Bureau of Public Roads
EPB	=	Economic Planning Board
KHC	=	Korea Highway Corporation
KNR	=	Korean National Railroad
MOC	=	Ministry of Construction
MOF	=	Ministry of Finance
MOT	=	Ministry of Transportation
PCBs	=	Provincial Construction Bureaus
RCBs	=	Regional Construction Bureaus
TCMC	=	Transport Coordination Ministers Conference
TPO	=	Transport Planning Office
UNDP	=	United Nations Development Programme
GDP	=	Gross Domestic Product
GNP	=	Gross National Product
vpd	=	vehicles per day

KOREA

APPRAISAL OF A FIRST HIGHWAY PROJECT

TABLE OF CONTENTS

This report was written by Messrs. P. R. Morris (Engineer), H. Hansen and A. F. Ballereau (Economists), and was edited by Mrs. P. Valad.

TABLE OF CONTENTS (Continued)

KOREA

APPRAISAL OF A FIRST HIGHWAY PROJECT

SUMMARY AND CONCLUSIONS

i. This report appraises the First Highway Project in the Republic of Korea proposed for Bank financing. The project comprises: construction of 372 km of primary national highway between Chonju and Pusan, including supervision by consultants; feasibility studies of about 1,400 km of primary national highways; detailed engineering of about 1,100 km of primary national highways; a highway maintenance study; and establishment of a national highway maintenance organization in a "pilot" province, including procurement of equipment and spare parts.

ii. The economy of Korea has been growing very rapidly during the last 10 years, due mainly to a sharp increase in industrial production and exports. The annual growth rate of real Gross National Product accelerated from 3.5% in 1962 to 15.9% in 1969, while the value of commodity exports increased at an average of 39% p.a. in recent years. By 1969, all the major targets of the Second Five-Year Economic Development Plan for 1971, except in agriculture, had been exceeded.

iii. Korea's transport system has been severely strained over the past decade by the extremely rapid economic expansion. The Government's initial efforts to improve transport gave priority to railroads, with financial assistance by foreign governments and the Bank Group. Meanwhile, the Bank made a special grant for a Transportation Survey, completed in 1966. Between 1965 and 1969, in line with the recommendations of the Survey, the Government sharply increased annual transport investments, particularly for highways, but demands still were not satisfied. More recently, the Association provided the Government with a credit of US$3.5 million (S4 KO, July 1968) for highway feasibility and detailed engineering studies, as well as a highway organization and transportation coordination survey. The proposed First Highway Project stems directly from these studies.

iv. The highway between Chonju and Pusan links the major cities of Kwangju, Sunchon, Chinju, and Masan and highly populated rural areas in the southwest. The present road is narrow and poorly aligned, with a rough gravel surface, except for the Masan-Pusan section which is paved but narrow and congested. Reconstruction to a two-lane paved standard is of high priority and should yield a rate of return of 28% from savings in vehicle operating costs and time.

v. Feasibility studies, detailed engineering, and a highway maintenance study by consulting firms, as well as purchases of mechanical equipment for highway maintenance, are included in the project. The feasibility studies will cover a further 1,400 km of primary national highways identified by the Transportation Survey as likely to be of high priority, with subsequent detailed

engineering of about 900 km if found justified. In addition, detailed engineering of about 200 km of national highways between Wonju-Kangnung and Mukho-Sokcho (studied under Credit S4 KO) is included. The comprehensive study of national highway maintenance will help the Government improve organization, administration, and methods, as well as assess the need for facilities, equipment, and funds. The mechanical equipment to be purchased will be for setting up a new national highway maintenance organization in the pilot province of Gyeongi-do.

vi. The total project cost, including contingencies but excluding refunding Credit S4 KO, is US$102.5 million. A Bank loan of US$54.5 million is proposed, of which US$45 million is for foreign exchange costs, US$6 million for local costs, and US$3.5 million for refunding Credit S4 KO. The balance of the local costs (US$51.5 million or about 50% of the total project cost) will be made available by the Government. The contracts for construction and for supply of equipment will be awarded after international competitive bidding; construction supervision and other expert services will be carried out by consultants. The Ministry of Construction, through its Bureau of Public Roads, will be responsible for project execution and administration.

vii. The proposed project provides a suitable basis for a Bank loan to the Government of US$54.5 million. Based on the economic life of the project, an appropriate term is 24 years, including a four-year period of grace.

KOREA

APPRAISAL OF A FIRST HIGHWAY PROJECT

I. INTRODUCTION

1.01 The Government of the Republic of Korea has asked the Bank to help finance a highway project consisting of: (a) construction of 372 km of a national primary highway from Chonju to Pusan, including supervision by consultants; (b) feasibility studies by consultants of about 1,400 km of national highways; (c) detailed engineering by consultants of about 1,100 km of primary national highways; (d) a highway maintenance study by consultants; and (e) establishment of a national highway maintenance organization in a "pilot" province, including procurement of mechanical equipment and spare parts.

1.02 Although this would be the first highway project in Korea to be financed by the Bank Group, we have been involved in the transport sector since 1962 through three railroad projects (Credits 25 KO, US$14 million, 1962 and 110 KO, US$11 million, 1967; and Loan 669 KO/Credit 183 KO, US$55 million, 1970) (para. 2.10), a Bank grant of US$200,000 in 1965 for a Transportation Survey, and a credit (S4 KO) of US$3.5 million in 1968 for highway studies. Performance on these projects has been generally satisfactory. The proposed project is in line with the Transportation Survey, which recommended that investment in highways should be greatly increased. It is based on highway feasibility studies and detailed engineering by consultants under Credit S4 KO.

1.03 This report was prepared from information supplied by the Government and the recommendations of their consultants, as well as the findings of the November/December 1970 Bank appraisal mission, composed of Messrs. P. R. Morris (Engineer), H. Hansen, and A. F. Ballereau (Economists). The report was edited by Mrs. P. Valad.

II. BACKGROUND

A. Economic Setting

2.01 The economy of Korea has grown rapidly during recent years, largely because of the unusually high growth rate of the industrial sector. The annual average growth rate of real Gross National Product (GNP) increased from 7% during 1962-64 to 11.4% during 1965-70 despite droughts in 1967 and 1968. GNP is expected to grow at 10% p.a. in 1971, with a long-term average annual growth rate of 8.6%. Per capita GNP was about US$233 in 1970.

2.02 With a total land area of 98,000 km^2 (roughly the size of Guatemala or Portugal) and a population of about 31.8 million in 1970, Korea has a density of 320 inhabitants/km^2; this is higher than Japan (270) but less than Taiwan (360). In the past decade, family planning was vigorously implemented,

resulting in decreased population growth from 3% to 2.1% p.a.; the Government plans a further reduction to 1.5% p.a. by 1976. Industrialization has been accompanied by a population shift from rural to urban areas, where more than half now live (about 15% in the greater Seoul area). During 1960-69, unemployment was reduced from 8% to about 5%.

2.03 Industrialization, supported by development of the economic infrastructure, has played a leading role in Korea's economic growth. During 1965-70, the manufacturing and social overhead sectors increased by 17% p.a., while agriculture grew by 3-4% p.a. The share of agriculture in total Gross Domestic Product (GDP) fell from 39% in 1965 to 27% in 1970, whereas that of manufacturing and mining rose from 20% to 28%. Thus, in less than a decade, the Korean economy has been transformed from predominantly agricultural to semi-industrialized. Exports of manufactured goods have greatly increased from less than US$90 million in 1962-64 to almost US$900 million in 1970. Two-thirds of exports by value now are manufactured products. Regarding producer goods, the fastest growth was in production of fuels, cement, electrical machinery and appliances, electronics, chemicals, and petrochemicals. Seoul and Pusan are the foremost industrialized cities, but the Government's policy is to promote manufacturing in other cities and populated rural areas throughout the country.

2.04 Agriculture in Korea is limited because less than 30% of the land is arable; the remainder is mountainous terrain and rivers. However, agriculture, forestry, and fishing are the livelihood for about half the population; for this reason, the Government is increasing considerably its investments in irrigation, land reclamation, and fertilizer development. Rice and barley are the most important agricultural products, constituting the staple diet of the population. Livestock and cereal production for market have increased considerably due to rising urban demand and government promotion.

B. Transportation

(a) General (Tables 1 and 2)

2.05 The very rapid expansion of production and exports has led to greater demand for freight and passenger transport. As the transport sector demand and investments have increased, its value-added has grown faster than GDP. Annual transportation investments, including storage and communications, increased from W20.4 billion (US$65 million) in 1965 to W126.2 billion (US$400 million) in 1969, or from 17% to about 28% of the total capital formation. The transport sector's contribution to GDP during the same period rose from 3.4% to 4.5%.

2.06 Domestic passenger and freight movements increased between 1965 and 1969 at an average annual rate of about 17%. Despite rapid growth in traffic by road and coastal shipping, the railroads continued to be the predominant freight carrier. However, their share declined from an average of 87% in 1960-65 to 68% in 1969, due mainly to the rapid growth of coastal shipping. Since 1965, road transport has taken the lead for passengers from railroads and accounted for 60% of pass-km in 1969.

2.07 The Third Five-Year Economic Development Plan (1972-76), presently being prepared by the Economic Planning Board (EPB), is likely to allocate investments to the transport sector at least equal to the present proportion of about 25% of the total capital formation. The tentative Plan indicates that the focus of transport development will shift to emphasize road construction, although railways will continue to absorb a substantial amount of the investment.

(b) Highways (Table 3)

2.08 Until 1967, road transport played a relatively small role and highway construction was given low priority. Even now, only 8% of the 37,000 km of public roads are paved (including 25% of the national highways); the remainder are gravel or earth surfaced. Lack of investments in roads and poor maintenance have led to high road transport costs. The highway system is discussed further in Chapter III.

(c) Railroads

2.09 The railroads are operated by the Government's Korean National Railroad (KNR); KNR is controlled by the Ministry of Transportation (MOT), which has authority over rates and fares and staff matters. The KNR has an independent general manager and its own budget and commercial accounting system. The network consists of 3,100 km of standard gauge track and 126 km of narrow gauge; about 470 km are double tracks. Between 1965 and 1969, passenger traffic grew 12.5% p.a.; in 1969, railroads carried 11.1 billion pass-km or 40% of all passenger traffic. Most passenger traffic (88%) is long distance. Between 1965 and 1969, freight traffic increased 9.8% p.a.; in 1969, railroads carried about 7.3 billion ton-km or 68% of all freight traffic. Freight consists mainly of bulk commodities (anthracite coal, oil, cement, fertilizers, and grain) and the average haul is about 240 km. Freight traffic under 50 km is prohibited, except for coal.

2.10 Although there has been a shortage of managerial skills in some fields, operations are generally efficient. The main constraints on railroad operations have been the shortage of rolling stock, limited capacity of key lines, and obsolete communication system. Thus, railroad investments have been concentrated on expanding motive power and rolling stock and increasing stations and line capacity. These improvements have been financed by loans and grants from Japan, the United States, and the World Bank Group.

(d) Ports and Shipping

2.11 The increase in domestic and foreign trade is reflected in a growing demand for ocean and coastal shipping, which cannot be handled efficiently because of lack of vessels and inadequate port facilities. However, tonnage handled by ports increased from about 11.3 million m tons in 1965 to 36.2 million m tons in 1969, mainly due to increased imports of grain, oil, and lumber, and some diversion of fuel and cement transport from the overburdened railroads. In 1969, ports handled 17.1 million m tons of imported goods and 2.9 million m tons of exported goods, which reflects Korea's dependence on

importing industrial raw materials. Coastal shipping amounted to 16.2 million m tons. Pusan and Inchon are both general and bulk cargo ports, handling about 22% and 15%, respectively, of total cargo in Korea. Ulsan and Yosu are oil-handling ports, handling about 25% and 10%, respectively, of total cargo.

2.12 The Ministry of Construction (MOC) is responsible for planning, constructing, and maintaining 16 first-class ports, which include Pusan, Inchon, Ulsan, Yosu, Gunsan, and Mokpo, and 24 second-class ports. All other ports come under the governor of the respective province where they are located. The MOT is responsible for daily operation, while cargo is handled by private stevedoring companies. Revenues from port charges are not presently sufficient to cover expenditures for investment, maintenance, and other services.

2.13 In 1970, the Bank assisted the Government in obtaining financial assistance from the United Nations Development Programme (UNDP) for a development study of Korea's main ports. The Bank is the Executing Agency for the study, which is expected to result in projects suitable for Bank financing from FY 1973 onwards.

2.14 Vessels registered under the Korean flag are mainly oil tankers and coastal bulk carriers. Gross registered tonnage increased from 370,000 in 1965 to 1,122,000 in 1969, and the total number of vessels grew from 11,830 to 16,900 in the same period.

(e) Aviation

2.15 Air traffic remains comparatively small; the privately-owned Korean Air Lines provides domestic and some international flights; Korea is also served by other international airlines. Air traffic increased from 285,000 passengers in 1965 to 887,000 in 1969, due mainly to an increase in domestic passengers. Most traffic is handled at the Seoul-Kimpo International Airport, which may be expanded. Pusan is the second international airport. Air freight is expanding rapidly, but still is of minor importance.

C. Transport Planning and Coordination

2.16 The limited funds available and inadequate transport planning have been obstacles to meeting the rapidly growing transport demand. Investments have not always been made according to economic priority because alternative solutions have not been studied. Responsibility for planning has been scattered; the MOC has been responsible for roads and ports, and the MOT for airports, the KNR, shipping, and road transport regulation. The EPB has been the only organization in a position to coordinate transport investments, but it has not been staffed for this purpose.

2.17 To provide a basis for improving transport planning and coordination, a study was financed under Credit S4 KO and carried out by the consultants BCEOM/NEDECO (France/Netherlands). The consultants' final report (May 1970) suggested, as a long-term solution, placing responsibility for all

transport modes under one Ministry. This was not acceptable to the Government so BCEOM/NEDECO proposed setting up a new three-tiered organization responsible for transport planning and coordination. This would consist of:

(a) Transport Coordination Ministers Conference (TCMC), a policy committee chaired by the Deputy Prime Minister and composed of the eight ministers most concerned with transport matters;

(b) Transport Coordination Working Group, a civil service committee representing the same ministries as those in the TCMC but dealing with lesser policy matters and referring major issues to the TCMC; and

(c) Transport Planning Office (TPO), a full-time staff for the TCMC, under the Deputy Prime Minister.

As recommended, the Government set up the three bodies in 1970, but the TPO was placed in the MOT. The Government has thus taken steps to improve transport planning and coordination. The measures now being studied, with technical assistance by BCEOM/NEDECO, include reviewing transport regulation, licensing, taxation, and rate structures. However, it is too early to see how effective this somewhat complicated system will be.

III. THE HIGHWAY SECTOR

A. The Highway Network (Table 3)

3.01 The public road network is about 37,000 km long, consisting of about 8,600 km of national highways (including 470 km of expressways) and 28,500 km of provincial and local roads. The national highways include expressways, primary, and secondary roads, under the authority of the Minister of Construction. The local roads include provincial, special city (Seoul and Pusan) 1/, city, and county roads, under the respective local authorities. The average road density is 0.4 km of road per km^2 of land area and 1 km of road per 850 inhabitants (these ratios are 2.7 km road per km^2 and 1 km per 100 inhabitants in Japan; 0.4 km road and 1,400 inhabitants in Thailand; and 0.2 km road and 600 inhabitants in the Philippines).

3.02 Most roads are badly aligned, narrow, poorly drained, and either roughly surfaced with gravel or unsurfaced; only about 3,100 km (8%) are paved, including 2,100 km (25%) of national highways. This poor condition reflects the low priority the road network had received in the past. In line with the recommendations of the Bank-financed Transportation Survey (para. 1.02), the Government increased road investments sharply from 1967. However,

---

1/ These two cities are called "special" cities because their administrative status includes higher responsibilities than other cities.

most funds have been devoted to expressway construction, particularly the 450 km long Seoul-Pusan toll expressway. As a result, inadequate attention has been given to maintenance of existing roads. Recognizing this need, the Government intends, during the Third Five-Year Economic Development Plan (1972-76) (para. 2.07), to improve and pave about 50% of the most heavily trafficked national highways. The Government also intends to make substantial improvements in highway maintenance.

B. Highway Traffic (Tables 4 and 5)

3.03 The motor vehicle fleet at the end of 1969 consisted of about 109,000 units compared with 31,000 in 1962, an average increase of 20% p.a. Between 1967 and 1969, the increase accelerated to 34% p.a. Although increasing rapidly, the vehicle fleet is still very small (1 vehicle per 300 persons compared with 1 per 110 in the Philippines and 1 per 100 in Thailand). Gasoline and diesel consumption increased between 1962 and 1967 by 27% and 17% p.a., respectively, and between 1967 and 1969 by 26% and 55% p.a., respectively.

3.04 The vehicle fleet is relatively small because of the Government's long-standing policy of severely restricting vehicle imports. However, in 1966 the first vehicle assembly plant was established, and the Government relaxed restrictions on importing parts. Two more companies have since established assembly plants. The three companies are associated with Toyota, Ford, and Fiat; they have a combined assembly capacity of more than double the total output of 31,000 vehicles achieved in 1969. The Government expects production to reach about 100,000 in 1974. To promote domestic industry and to save foreign exchange, the Government is still restricting imports of assembled vehicles and parts. The largest manufacturer has already reached a local content of 45% for cars, 50% for trucks, and 80% for buses. The Government hopes that a maximum local content of production will be reached by 1974. As this goal is approached, the Government may reduce the vehicle taxation, which is particularly high on cars.

3.05 Present motor vehicle regulations allow a sufficiently high maximum single axle-load of 10 m tons, but may be unduly restrictive in some respects, such as the total weights and sizes of vehicles. During loan negotiations, assurances were obtained that the Government will review and revise the regulations governing vehicle weights and dimensions and implement them in accordance with an agreed time schedule.

3.06 Since 1965 MOC, assisted by local authorities, has made annual traffic counts. These have included nationwide origin and destination surveys of all primary and secondary national highways and main provincial highways. Counting is carried out at more than 30 stations once or twice a year during three consecutive working days (from 7 a.m. to 7 p.m.). Although a significant amount of traffic information is consequently available, it is not yet fully used for highway planning and maintenance programming. During loan negotiations, assurances were obtained from the Government that traffic counts will be continued and that the processing of traffic data will be improved.

C. Highway Administration (Table 6)

3.07 The principal defect in highway administration is the lack of a satisfactory organization for maintaining national highways (paras. 3.17 and 3.18). However, the Government plans to overcome this by setting up a new MOC field organization with sufficient staff, equipment, and financing (paras. 3.19 and 3.20); this will enable the provincial, county, and city governments to concentrate their limited resources on adequately maintaining their own roads. The existing organizations for highway planning, design, and construction, with the assistance of consultants on major works, are adequate.

3.08 The MOC (Chart 1), through its Bureau of Public Roads (BPR) (Chart 2), is responsible for the construction, maintenance, and administration of the national highway system, as well as for the formulation and execution of Government policy in relation to other roads. The MOC became responsible for maintenance of national highways only in January 1971; before then, maintenance was the responsibility of the provinces, assisted by grants for this purpose from the MOC (para. 3.12). The MOC does not yet have a field organization to carry out highway maintenance and this work is still being performed by the provinces. However, MOC is preparing to set up its own field maintenance organization for national highways (para. 3.19).

3.09 The Korea Highway Corporation (KHC), under the MOC, operates and maintains toll expressways. The Government intends that the KHC will also be in charge of constructing any future toll expressways. Also, under the MOC are two organizations which provide services for all types of work (including roads) undertaken by the MOC and the provinces: the National Construction Research Institute provides laboratory services, and the Office of Heavy Equipment supplies and maintains mechanical equipment (mainly for the MOC, but also to a limited extent for the provinces).

3.10 The BPR is presently a headquarters organization. In accordance with the recommendations of BCEOM/NEDECO in their study under Credit S4 KO (para. 1.02), the BPR was reorganized during 1970 into divisions dealing with planning, administration, finance, construction, and maintenance. Design and construction of national highways are carried out by the five Regional Construction Bureaus (RCBs), which also carry out construction for other agencies within the MOC.

3.11 The provinces are responsible for the construction, maintenance, and administration of the provincial highway system, except that unpaved provincial highways are maintained by the counties (guns). The special cities of Seoul and Pusan are responsible for all roads within their areas. The Provincial Construction Bureaus (PCBs) are responsible for designing and executing all provincial works, including road works. The cities and counties are responsible for roads other than the national or provincial systems.

D. Highway Planning and Financing (Tables 7 and 8)

3.12 Planning and financing of the national highway system, including expressways, are the responsibility of the MOC, administered through its BPR. The BPR Planning Division collects data on highways, including traffic figures. It also drafts the Five-Year Development Programs and the annual budgets, which are reviewed and coordinated by the EPB and the Ministry of Finance (MOF) and then incorporated into the national Five-Year Economic Development Plans and annual budgets. The drafts take into account the overall national objectives established by the EPB and the estimates of highway user revenues given by the MOF. The BPR also gives technical guidance on highway matters to the Ministry of Home Affairs and provinces, including reviewing requests from the provinces and special cities for road construction and maintenance grants. Planning of provincial roads is carried out by the provinces, and that of city and county roads by the respective local authorities.

3.13 Since 1967, road expenditures have been financed from earmarked revenues from road user charges (Table 7). The law provides for: (a) the Government highway budget to receive 75% of the gasoline and diesel tax and 100% of the transport tax levied on public passenger traffic on roads, and (b) the highway budgets of the provinces, cities, and counties to receive the annual vehicle tax, the vehicle acquisition tax, and the registration fees. Other user charges, such as customs duties (in excess of the general level), are not earmarked. Total road user charges have generally covered road expenditures (Tables 7 and 8) except during 1969, the peak year for the construction of the Seoul-Pusan expressway. The Government's long-term policy is for road expenditures to be limited to the earmarked revenues from road user charges. However, during periods when construction expenditures are exceptionally heavy, the shortfall is met from external and internal loans serviced from the earmarked revenues.

3.14 The Government's expenditure on highways under the Second Five-Year Economic Development Plan (1967-71) is expected to total about W90 billion (US$285 million). The Third Five-Year Economic Development Plan (1972-76) is being prepared, but a tentative draft suggests the allocation for highways will be about W160 billion (US$510 million). Of this, about W135 billion (US$430 million) will be for construction and improvement (including paving) of about 3,000 km of national highways. Government allocations for highway maintenance are also expected to be increased sharply.

E. Highway Design and Construction (Table 9)

3.15 These functions are carried out under the responsibility of various public services according to the category of highways concerned. The BPR is responsible for design and supervision of all road works financed by the Government. Under the BPR, a National Expressway Design and Survey Office has recently been set up for designing and supervising major construction works on principal national highways. The design work and supervision are mainly carried out by consultants. The five RCBs of MOC, under the technical direction of BPR and sometimes assisted by consultants, design and supervise other construction works on national highways. The KHC (para. 3.09) is intended

to be responsible for design and supervision of any future toll expressways which may be constructed. The design standards for primary national highways, given in Table 9, are reasonable.

3.16 Major construction works are almost entirely carried out by contracts awarded on the basis of competitive bidding. The Government does not impose restrictions on the way in which the work is carried out, including the use of mechanical equipment. The domestic contracting industry has developed rapidly in recent years. There are 550 contracting firms engaged in public works; 30 have undertaken substantial highway works and in 1969 the 10 largest firms were undertaking highway contracts ranging from US$2-15 million. Minor construction is sometimes undertaken by force account by the RCBs, the PCBs, and city and county construction sections. The Army also undertakes some road works, chiefly in the northern area. While little civil engineering work has been undertaken by foreign contractors, some have recently expressed interest in bidding on such works.

F. Highway Maintenance (Tables 10, 11 and 12)

3.17 Highway maintenance is unsatisfactory, chiefly due to weak and confused organization; insufficient financial allocations; outdated and inefficient methods; and insufficient and poorly maintained mechanical equipment, much of which is old. Pavements are not being resurfaced on a regular basis and shoulders are badly maintained and rough. The gravel surfaced roads (most of the roads) are usually surfaced with river gravel; no attempt is made to select or prepare the material, and it contains a high proportion of large stones and even boulders. This results in extremely rough and corrugated surfaces, aggravated by the lack of sufficient mechanical equipment to maintain them at the required intervals. Many gravel-surfaced national roads are already carrying traffic near the upper limit of their capacity. The result of unsatisfactory maintenance is that the entire road system (including the national highways) is in poor condition and that road transport costs are high.

3.18 The agencies which maintain the various classes of roads are shown in Table 6. Paved roads (including national highways) are maintained by the provinces; unpaved roads (including national highways) are maintained by cities/counties. The provinces and cities/counties have inadequate permanent maintenance forces, which are supplemented by a traditional system of communal labor; i.e., families are obligated to work without pay for three to four days each spring and fall, chiefly on digging, carrying, and spreading gravel on the roads. This labor is, of course, unskilled and difficult to supervise as it is supplied in very large numbers for short periods; productivity is very low.

3.19 The Government recognizes that maintenance is unsatisfactory, particularly for the national highway system. Although MOC, through its BPR, became formally responsible for the maintenance of national highways in January 1971, it does not yet have a highway maintenance field organization. As recommended by BCEOM/NEDECO, the Government is preparing a plan to set up such a field organization. Since this will be a major undertaking, it will

be carried out in three stages. Initially, from January 1972, this field organization will be established only in a pilot province (Gyeongi-do) under an existing RCB (in Suwon); the RCBs presently deal only with construction. Subsequently, from July 1974, the MOC field organization will take over the maintenance of all national highways based on the four remaining RCBs. Finally, by about July 1975, new regional offices of the BPR will be set up and will take over the RCBs' responsibilities, staff, and equipment for maintenance and construction of national highways.

3.20 The Government, assisted by BCEOM/NEDECO, has prepared an implementation schedule for establishing the MOC highway maintenance field organization (Table 10) as well as a detailed plan for setting up the pilot organization, with estimates of costs (Table 11) and mechanical equipment required (Table 12). To assist the Government in implementing the new maintenance system, the project will finance purchases of mechanical equipment for the pilot province. It will also include a detailed study of highway maintenance, by consultants, to help prepare the detailed implementation plan and schedule for setting up the nationwide MOC field organization for maintaining national highways; this will include a detailed maintenance program for five years and estimates of required funds, staff, installations, and mechanical equipment. During loan negotiations, assurances were obtained from the Government that it will: (a) set up the MOC pilot field organization for maintenance of national highways in accordance with the program and implementation schedule; (b) carry out the study of highway maintenance assisted by consultants, and agree with the Bank on a program for improving highway maintenance (including setting up the nationwide MOC field organization for maintaining national highways), all in accordance with the agreed time schedule; (c) carry out the agreed program and thereafter cause the national highway system to be adequately maintained, in accordance with sound engineering and highway practices, and provide promptly as needed the funds, facilities, services, and other resources required for such maintenance; and (d) make satisfactory arrangements for maintaining the roads to be constructed under the project, if necessary through interim measures pending effective implementation of the new MOC field organization.

IV. THE PROJECT

A. General Description

4.01 The project (see Map) consists of:

(a) construction of a 372 km national primary highway from Chonju to Pusan, with two-lane bituminous paving, including supervision by consultants;

(b) feasibility studies by consultants of about 1,400 km of national highways;

(c) detailed engineering by consultants of 200 km of national primary highways from Wonju to Kangnung and from Mukho to Sokcho;

(d) detailed engineering by consultants of about 900 km of national highways to be selected, if found justified, from the highways to be studied in (b) above;

(e) a highway maintenance study by consultants; and

(f) establishment of a national highway maintenance organization in a pilot province, including procurement of mechanical equipment and spare parts.

B. Construction of Chonju-Pusan National Primary Highway (Annex)

4.02 The road to be constructed links the major cities of Chonju, Kwangju, Sunchon, Chinju, Masan, and Pusan. The existing road from Chonju to Masan is narrow, poorly aligned, badly drained, and has a rough gravel surface, except for short paved sections near Sunchon and Masan. The Masan-Pusan section is paved, but is narrow and becoming increasingly congested.

4.03 The new highway will be built on a new alignment and will have a two-lane asphaltic concrete pavement 7.2 m wide. Shoulders will be 3 m wide, except for the lesser trafficked center section, Yonhwa-Masan, where they will be reduced to 1.75 m (Table 9). The standards, which have been reduced at the Bank's suggestion, are reasonable. The new highway, 372 km long, will be 56 km shorter than the existing road. The Masan-Pusan alignment was chosen to connect with an intra-urban link in Pusan to be financed and built by the Government/city (Annex, para. 11). During loan negotiations, assurances were obtained from the Government that it will: (a) provide sufficient funds for constructing the link, and (b) construct the link in a timely manner, including awarding the construction contract for the link before awarding any contract for the Bank-financed Masan-Pusan section.

C. Construction Supervision

4.04 The Government intends to retain the consulting firm Ingeroute (France) for construction supervision. Ingeroute prepared the feasibility study and detailed engineering for the highway, and the firm is acceptable for the construction supervision.

D. Feasibility Studies of National Highways for Future Projects (Table 13)

4.05 Feasibility studies, by consultants acceptable to the Bank, of the possible improvement or reconstruction of about 1,400 km of national primary

highways are included in the project. Improvement of these highways, including paving, appears to be of high priority (para. 5.03); they are expected to carry traffic varying between 500 and 3,000 vpd by 1976.

E. Detailed Engineering of Primary National Highways

4.06 The project includes detailed engineering, by consultants acceptable to the Bank, of two primary national highways: Wonju-Kangnung, 100 km; and Mukho-Sokcho, 100 km. Feasibility studies of these roads were financed under Credit S4 KO and carried out in 1969-71 by the consultants Ammann and Whitney/Trans-Asia (United States) and by Ingeroute. Construction of these highways is expected to cost around US$45 million, with a foreign exchange portion of about US$20 million; they could be the basis of a second highway project.

F. Detailed Engineering of Further National Highways

4.07 The project includes detailed engineering, by consultants acceptable to the Bank, of about 900 km of national highways to be selected, if found justified in agreement with the Bank, from the highways to be studied in D. above. Construction of these highways could be the basis of a possible third highway project; detailed engineering is included under this project, rather than under a second highway project, to avoid possible delay between carrying out feasibility studies and starting detailed engineering, which would delay preparing a third project. To avoid wasted expenditures, assurances were obtained from the Government during loan negotiations that it will not carry out any works other than maintenance or minor improvements on the highways included for feasibility study or detailed engineering (paras. 4.05 and 4.06) without prior consultation with the Bank.

G. Study of Highway Maintenance

4.08 The project includes a study, by consultants acceptable to the Bank, of the organization of highway maintenance and methods of carrying it out. This study will include:

(a) preparation of a detailed program for carrying out the reorganization of highway maintenance, including setting up a new field organization of the MOC for maintaining national highways (para. 3.19);

(b) preparation of a five-year maintenance program;

(c) assessment of mechanical equipment needs for highway maintenance; and

(d) assessment of capital and recurrent financial requirements for implementing the reorganization and carrying out the maintenance program.

The study could lead to Bank financing, under future projects, of purchases of mechanical equipment for maintaining the national highway system.

H. Procurement of Mechanical Equipment (Table 12)

4.09 To assist the Government in setting up the MOC field maintenance organization in a pilot province (para. 3.19), the project includes procurement of necessary mechanical equipment. The list has been prepared with the assistance of BCEOM/NEDECO (paras. 3.10 and 3.20).

I. Refunding of IDA Technical Assistance Project - Transport, Credit S4 KO

4.10 The proposed loan will provide US$3.5 million to refund the amount already disbursed under Credit S4 KO (about US$3.2 million) and to finance the consultants' services still to be completed (para. 2.17) as well as the training of government staff in the transportation field included in the Credit S4 KO project (about US$300,000).

J. Cost Estimates, Foreign Exchange Components, and Financing (Table 14)

4.11 The cost estimates for the project are summarized as follows:

	Won million			US$ million			% Foreign Exchange Component
	Local	Foreign	Total	Local	Foreign	Total	
A. Construction	13,660	9,120	22,780	43.4	29.0	72.4	40
B. Consulting Services:							
1. Supervision of A	410	630	1,040	1.3	2.0	3.3	60
2. Feasibility studies	250	570	820	0.8	1.8	2.6	70
3. Detailed engineering	910	1,260	2,170	2.9	4.0	6.9	60
4. Highway maintenance study	30	130	160	0.1	0.4	0.5	75
Sub-total	1,600	2,590	4,190	5.1	8.2	13.3	
C. Mechanical equipment and spare parts	a/	280	280	a/	0.9	0.9	100
D. Contingency allowances 20% on Item A (Quantities - 10% and Prices - 10%) and 10% on Items B and C	2,840	2,170	5,010	9.0	6.9	15.9	
Sub-total A-D	18,100	14,160	32,260	57.5	45.0	102.5	
E. Refunding of Technical Assistance Credit S4 KO	-	1,100	1,100	-	3.5	3.5	
Total A-E	18,100	15,260	33,360	57.5	48.5	106.0	

a/ Small amount for local handling and transport of imported equipment; also possibly a small amount of local manufacture/assembly if domestic suppliers submit successful bids for part of the equipment.

4.12 The cost estimates for construction have been prepared by Ingeroute on the basis of quantities after completing detailed engineering and of unit prices obtained for similar work after competitive bidding in 1970 (adjusted to cover increases to early 1971). Although these prices are predominantly based on contracts where bidding was restricted to local contractors, they are acceptable as indications are that the domestic construction industry is competitive and that international competitive bidding would not produce significantly different prices.

4.13 The cost estimates for consulting services for construction supervision, feasibility studies, and detailed engineering of further national highways are based on previous contracts for similar works in Korea. The cost estimates for the study of highway maintenance are based on an assessment of the man-months required.

4.14 The cost estimates for procurement of mechanical equipment to set up a national highway maintenance organization of the MOC in a pilot province are based on an assessment made by the consultants BCEOM/NEDECO (para. 3.10) and are satisfactory.

4.15 Contingency allowances of 20% for construction and 10% for consulting services and purchases of mechanical equipment are reasonable. The 20% for construction includes 10% for quantities of work and 10% for price increases estimated at an average of about 5% p.a. for both local and foreign currencies over the two-year period from the time the detailed estimates were prepared (April 1971) to the mid-point of the approximately three-year construction period; it is assumed that adjustments in the foreign exchange rate of the Won will reflect changes in the relative purchasing power of domestic and foreign currencies. The 10% allowance for mechanical equipment includes 5% for additional purchases of unforeseen equipment items and 5% for price increases between March 1971, when the estimates were prepared, and the shipment of the equipment. The 10% allowance for consulting services is for unforeseen increases in the man-months of work involved in supervision, studies, design, and other services.

4.16 The estimated foreign exchange component of the construction cost is based on the consultants' estimates of 50% when work is carried out by foreign contractors and 38% when carried out by domestic contractors, in each case following international competitive bidding. The domestic civil engineering contracting industry is well developed and is expected to win most of the 10 contracts to be awarded under the project. Assuming that 75% of the work is carried out by domestic contractors and 25% by foreign contractors, the resulting foreign exchange component is about 40%.

4.17 The foreign exchange component of consulting services varies between 60% and 75% for different types of service. The cost of mechanical equipment for road maintenance probably will be entirely in foreign exchange, except small amounts for such items as local handling and transport. Domestic manufacturers (chiefly of vehicles) may bid, but they are not expected to win contracts for a substantial proportion of the equipment, with a margin of preference limited to 15% over foreign bidders.

4.18 The proposed loan of US$54.5 million will finance 47% (US$41 million) of the cost of construction; the foreign exchange cost (US$10 million) of consulting services and mechanical equipment and spare parts purchases; and the refunding of Credit S4-KO (US$3.5 million). The Bank's participation in construction would cover the foreign exchange component (US$35 million) and some local currency expenditures (US$6 million). The balance of the local costs (US$51.5 million), amounting to about half the total project cost, will be met by the Government. From experience with previous loans, no difficulties are expected in making adequate provision in the budget; an assurance on this was obtained from the Government during loan negotiations.

K. Project Execution, Procurement, and Disbursements (Table 15)

4.19 The MOC, through its BPR, will be in charge of the execution and administration of the project, which will be carried out by contractors and consultants. Highway construction will be carried out through contracts awarded on the basis of international competitive bidding. Construction supervision, feasibility studies, and detailed engineering for future projects, as well as the study of highway maintenance, will be carried out by consultants acceptable to the Bank; assurances on this were obtained from the Government during loan negotiations. The mechanical equipment will be purchased on an international competitive bidding basis, with bids evaluated on the c.i.f. landed cost; assurances on this, and that the Government will not place restrictions on the importing of equipment for this project, were obtained from the Government during loan negotiations.

4.20 The work included in the project is expected to take about three years and, allowing for awarding contracts and making final payments on completion, disbursements would take about four years. The timing of project execution was agreed during loan negotiations.

4.21 Disbursements of the loan would be made to the Government on the basis of:

Highway construction - 47% on the cost of the works;

Consulting services - the actual foreign exchange cost of payments to consultants; and

Equipment - the c.i.f. landed cost of imported mechanical equipment, and 90% of the ex-factory price of any locally produced equipment.

4.22 The Government will acquire the right-of-way for the road sections to be constructed, and has adequate powers for this purpose. During loan negotiations, assurances were obtained from the Government that the right-of-way will be acquired before awarding the construction contract for each contract section.

V. ECONOMIC EVALUATION

A. General

5.01 In line with the recommendations of the Bank-financed Transportation Survey (para. 1.02) and the Government's recognition that highway infrastructure was inadequate, in 1968 the Government greatly increased the allocation for highway construction (para. 3.02). At the same time, the Government asked the Association to assist in financing feasibility studies of selected high priority roads identified in the Transportation Survey.

5.02 The objectives of the project are to:

(a) reduce transport costs on the important primary highway connecting the cities of Chonju-Kwangju-Sunchon-Masan-Pusan;

(b) establish the technical and economic feasibility and provide the detailed engineering of other roads identified as being of high priority by the Government and their consultants, BCEOM/NEDECO; and

(c) improve the organization and operations of the BPR, particularly for highway maintenance, including setting up a maintenance organization in a pilot province.

5.03 The justification for construction (para. 4.01(a)) is based primarily on savings in vehicle operating and time costs (paras. 5.07 and 5.08). The justification for including the feasibility studies (para. 4.01(b)) is based on reconnaissance studies made by the Government and BCEOM/NEDECO and on the subjective judgment of the Bank staff; subsequent detailed engineering (para. 4.01 (d)) would be undertaken only if supported by the feasibility studies. The justification for the detailed engineering of Wonju-Kangnung and Mukho-Sokcho highways (para. 4.01(c)), is that feasibility studies under Credit S4 KO have established that their construction would yield a satisfactory rate of return. The highway maintenance study (para. 4.01(e)) is required as a basis for establishing the MOC highway maintenance field organization and for preparing a Five-Year Program for highway maintenance. The procurement of mechanical equipment (para. 4.01(f)) is required for setting up the pilot maintenance organization, an essential step toward establishing the nationwide highway maintenance organization; the equipment will also result in improved maintenance of highways in the pilot province and, although not quantified, reduced vehicle operating costs.

B. Chonju-Pusan Road (Tables 4, 5, and 16-18)

5.04 The Chonju-Pusan road is the main road running north-south from the city of Chonju (population about 220,000) in west-central Korea via Kwangju (about 400,000) to Sunchon (about 80,000) in the southwest. From Sunchon, the road runs near the southern coast via Chinju (about 110,000) and Masan

(about 160,000) to Pusan (about 1.4 million), the second largest city in Korea and its main port. The influence area of the road includes the important southwestern agricultural area and the rapidly developing industrial area along the southern coast.

5.05 Average daily traffic on the road in 1970 ranged from about 300 vpd on the Yonhwa-Masan section to about 2,500 vpd between Masan and Pusan; about 35% were passenger cars and taxis and 65% heavy vehicles. Based on available Government counts, traffic on the existing road has grown by about 22% p.a. between 1967 and 1969. As part of the feasibility studies and subsequent detailed engineering, Ingeroute undertook detailed traffic counts in 1969 and 1970. These showed traffic growth rates of about 29% p.a. (36% for cars, 19% for buses, and 28% for trucks), which support the high traffic growth rates projected in the feasibility study (para. 5.06). The motor vehicle fleet in the influence area increased by about 37% between 1968 and 1969. Information on the growth of the motor vehicle fleet and gasoline consumption in Korea is given in Tables 4 and 5.

5.06 Table 16 shows present and expected traffic volumes on the Chonju-Pusan road. Traffic assignments between the existing road and the new highway have been made by Ingeroute after origin and destination surveys. Based on recent traffic trends and projections of total population by Ingeroute, production of goods and services, and per capita income, it is assumed that traffic will grow at an annual rate of about 22% p.a. until 1973 and then gradually decline to about 9% p.a. by 1988. The growth rates are high but reasonable under the circumstances. The traffic forecasts and economic evaluation have been based on the Government's stated policy that tolls will not be levied on the two-lane road. During loan negotiations, assurances were obtained from the Government that tolls will not be levied on any section of the road without the concurrence of the Bank, and that if any tolls are imposed, the levels will be determined in consultation with the Bank.

5.07 Reduction in vehicle operating and time costs, due to improved running surfaces, improved alignment, and considerable route shortenings, is the readily quantifiable benefit used in the economic evaluation. Savings include only the difference between present and expected operating cost levels and do not take into account the increased operating costs which would take place if the project were not carried out, nor do they include benefits from a reduction in accidents.

5.08 Considering the savings in vehicle operating and time costs (taking into account the estimated traffic growth over 20 years) and the additional maintenance cost, the investment in the whole road will yield a rate of return of 28%, ranging from 22% for the Yonhwa-Masan section to 32% for the Masan-Pusan section. Exclusion of passenger time savings would reduce the rates of return by about four percentage points. The sensitivity of these results was tested on the basis of a plus or minus 10% change in construction costs and 20% change in benefits. This resulted in a range of 24% to 33% as the minimum and maximum possible returns for the road. In view of the unusually high traffic growth projections, a separate sensitivity analysis was made

assuming a 25% lower traffic growth rate. This resulted in a rate of return of 23%. Returns on the various combinations are given in Table 18. The project is, therefore, justified.

VI. RECOMMENDATIONS

6.01 During loan negotiations, the Government gave assurances on a number of points. The most important of these are that the Government will: (a) set up, in accordance with an agreed program, a MOC field organization for maintenance of national highways (para. 3.20); (b) finance and construct an intra-urban link in Pusan to connect with the Masan-Pusan section to be financed under the loan (para. 4.03); and (c) not levy tolls on the road to be constructed as part of the project (para. 5.06).

6.02 The proposed project constitutes a suitable basis for a Bank loan of US$54.5 million equivalent, with a term of 24 years, including a four-year grace period.

KOREA

FIRST HIGHWAY PROJECT

Details of Construction of Chonju-Pusan National Primary Highway

1. The 372 km primary national highway between Chonju and Pusan can be divided, according to traffic volume, into three sections: Chonju-Kwangju-Yonhwa, 138 km, Yonhwa-Sunchon-Chinju-Masan, 182 km; and Masan-Pusan, 52 km.

A. Chonju-Kwangju-Yonhwa Section (138 km)

2. A four-lane divided highway, completed in 1969, connects Seoul and Taejon (155 km) and is part of the Seoul-Pusan toll expressway. Early in 1971, a further 80 km of two-lane paved highway was completed from Taejon to a point 9 km north of Chonju; the new highway will start at this point. The existing road is 142 km: Chonju-Kwangju, 111 km; and Kwangju-Yonhwa, 31 km. The road is unpaved, with a river gravel surface containing many large stones which corrugates badly under the traffic averaging in 1970 about 600 vpd. The alignment varies from fair to poor, mainly following the river valleys, but crossing a mountain pass near Sanam (halfway between Chonju and Kwangju), where gradients reach 9% and many curves are sharp. Average travel speed in dry weather is about 45 km/h, but is considerably reduced in wet weather. Drainage is poor.

3. Under the project, a new two-lane paved highway will be constructed on an improved alignment roughly parallel to the existing road. The new highway will have a 7.2 m wide asphaltic concrete pavement, and 3 m wide shoulders with a single bituminous seal coat. These specifications are reasonable for the traffic of about 1,000 vpd expected when the road is completed. The geometric design standards are given in Table 12; the terrain is about 75% flat, 15% rolling, and 10% mountainous. To improve the alignment, including reducing the maximum gradient to 6.5%, a tunnel 690 m long will be constructed in the mountainous area. The construction will include 35 new bridges, the longest being 462 m.

4. This section includes construction to similar design standards, of an 8 km link to Chonju and a 10 km link to Tamyang. The saving in distance on the new highway between Chonju and Kwangju will be about 6 km, but for through traffic from north of Chonju to east of Yonhwa (via the by-passes) it will be over 20 km.

B. Yonhwa-Sunchon-Chinju-Masan Section (182 km)

5. The existing road is 214 km: Yonhwa-Sunchon, 66 km; Sunchon-Chinju, 93 km; and Chinju-Masan (to the junction with the Taegu road 4 km west of Masan), 55 km. The existing road is unpaved except for about 6 km near Sunchon. It is narrow (a total width between 5 and 7 m and virtually no shoulders), poorly aligned, poorly drained, and surfaced with coarse river

gravel. The road crosses much rolling country and some mountainous areas, with gradients as steep as 9% and occasionally 11%. The normal average running speed for traffic is 40-45 km/h. The bridges are narrow and weak, and the culverts are insufficient. The road passes through several small towns and villages where buildings are constructed on the edge of the right-of-way (only about 10 m wide) causing extremely hazardous traffic conditions.

6. The new highway will have an asphaltic concrete two-lane pavement 7.2 m wide. The shoulders on this section will be only 1.75 m wide and will not have a bituminous seal coat. The specifications are reasonable for the terrain and traffic volume, which is expected to be around 600 vpd when the new road will have been completed. The new alignment will cross terrain which is about 65% flat, 20% rolling, and 15% mountainous. There will be 83 new bridges, including one of 600 m (Somjin River) and one of 385 m (Nam River), and two tunnels, one 170 m long between Sunchon and Chinju and one 555 m long between Chinju and Masan.

7. The new alignment will be 10 km shorter between Yonhwa and Sunchon, 12 km shorter between Sunchon and Chinju, and 6 km shorter between Chinju and Masan. The saving for through traffic on the entire distance between Yonhwa and Masan (by-passing the towns) will be 34 km.

C. Masan-Pusan Section (52 km)

8. This section will start from the Taegu road junction, 8 km west of Masan, since the traffic from there to Masan, and from Masan to Pusan (presently in the range of 2,000 to 4,000 vpd with 65% heavy vehicles) is substantially heavier than on the remaining project sections. Except for an unpaved 4 km west of Masan, the existing road has a 6 m wide pavement in fair condition, but shoulders only 0.5 m wide. Average travel speed is only about 40 km/h and congestion is considerable because of the high traffic volume, the narrowness of the existing road, and the indifferent alignment of parts of its length.

9. The new highway will be constructed on a new alignment. It will be fairly close to the existing road for about 20 km from the western end, but will include a 4 km by-pass on the north side of the city of Masan. The center 20 km will be on a new and more direct route. The remaining 11 km again will parallel the existing road to the end of the project section at Kupo, on the western side of Pusan. There the new highway will join a 5 km intra-urban link, which will be built by the Government and the city of Pusan to connect Kupo with the northeastern section of Pusan. The end of the new highway also will connect with the existing road, which follows the eastern bank of the Naktong River south from Kupo to the port, and old downtown area, of Pusan. The existing road is congested and is being widened to four lanes; the Government expects this work to be completed by the end of 1973.

10. The new highway will have an asphaltic concrete, two-lane pavement 7.2 m wide; the shoulders will be 3 m wide with a bituminous seal coat. The work includes building a major bridge 1,300 m long over the Naktong River, as

well as 25 other bridges. The alignment is about 70% in flat, and 20% in rolling terrain, with a short section crossing a narrow but steep mountain ridge where a tunnel 390 m long will be constructed.

11. The alignment selection for the Masan-Pusan section was based on the Government's stated intention to build the Kupo intra-urban link (para. 4.03). The Government had a preliminary technical study of the link carried out; it was started in December 1970 and completed in April 1971. The Government confirmed its previous statements that this link was required as part of the Pusan urban plan, and that it would finance, engineer, and construct the link separately from the project. The Government has stated that detailed engineering of the link is nearing completion and that construction is expected to start in July 1971 and to be completed ahead of the Bank-financed Masan-Pusan section.

D. Feasibility Studies and Detailed Engineering Of Road Sections to be Constructed

12. Feasibility studies of the road sections to be constructed were carried out in 1969-70 by the consultants Ingeroute (France) under Technical Assistance Credit S4 KO. The same firm carried out detailed engineering, completed in April 1971; this was also financed under Credit S4 KO.

TABLE 1

KOREA

FIRST HIGHWAY PROJECT

Domestic Freight and Passenger Traffic Data, 1965 and 1969

Freight	1965 Ton-km (million)	1965 (%)	1969 Ton-km (million)	1969 (%)	1965-69 Average Annual Increase (%)
Highway	503	8.5	1,307	12.1	27.0
Railroad	5,044	87.0	7,328	68.2	9.8
Coastal shipping	263	4.5	2,107	19.7	68.0
Total	5,810	100.0	10,742	100.0	16.6

Passenger	Pass-km (million)	(%)	Pass-km (million)	(%)	
Highway	7,975	43.0	16,688	59.2	20.2
Railroad	6,917	55.0	11,077	39.3	12.5
Coastal shipping	182	1.5	257	0.9	9.0
Air	63	0.5	179	0.6	29.8
Total	15,137	100.0	28,201	100.0	16.9

Source: Statistics Yearbook of Transportation, 1970, Ministry of Transportation

December 1970

KOREA

FIRST HIGHWAY PROJECT

Government Transport Investments During Second Five-Year Economic Development Plan, 1967/71

Transport Mode	Billion Won
Highways	90.1
Railroad	86.3
Ports and Maritime Transport	28.8
Airports	4.0
Other	1.3
Transport Sub-total	210.5
Total of Five-Year Plan	777.9
Transport as proportion of total	27%

Source: Ministry of Construction

May 1971

KOREA

FIRST HIGHWAY PROJECT

Public Roads Network, 1970
(km)

Category and Type	Total Length	Paved	(%)	Graveled	Unsurfaced
National Highways					
Expressways	470	470	100	-	-
Other national highways (primary and secondary roads)	8,120	1,650	20	6,470	-
Sub-total	8,590	2,120	25	6,470	-
Local Roads					
Provincial highways	10,820	120	1	10,180	520
Special city roads	2,740	450	16	1,850	440
City and county roads	15,020	430	2	11,920	2,670
Sub-total	28,580	1,000	3	23,950	3,630
Total	37,170	3,120	8	30,420	3,630

Source: Ministry of Construction

December 1970

TABLE 4

KOREA

FIRST HIGHWAY PROJECT

Motor Vehicle Statistics, 1962-70

Year	Cars[1]	Trucks	Buses[2]	Others[3]	Total
1962	8,733	13,093	6,747	2,241	30,814
1963	9,569	13,929	8,132	2,598	34,228
1964	11,409	14,951	8,617	2,836	37,813
1965	13,001	16,015	9,316	3,179	41,511
1966	17,502	19,432	10,888	2,338	50,160
1967	23,235	22,955	11,499	3,008	60,697
1968	33,112	31,582	12,786	3,471	80,951
1969	50,299	40,134	14,237	3,999	108,669
1970[4]	56,254	45,720	14,831	3,519	120,324
% Annual Change					
1962-69	28.2	17.3	11.2	8.5	19.7
1967-69	47.1	32.2	11.3	15.2	33.8
% Changing Composition					
1962	28.3	42.5	21.8	7.4	100
1969	46.3	36.9	13.1	3.7	100

1/ Includes taxis.

2/ Includes microbuses.

3/ Public service, motorcycles, and special vehicles.

4/ Estimated.

Sources: Ministry of Commerce and Industry and Mission Estimates

December 1970

KOREA

FIRST HIGHWAY PROJECT

Motor Vehicle Fuel Consumption, 1962-69 [1/]
(kiloliters)

Year	Gasoline	Diesel
1962	108,150	225,190
1963	97,000	275,680
1964	97,480	274,740
1965	158,240	270,670
1966	239,180	256,795
1967	372,920	281,420
1968	493,900	510,120
1969	593,950	681,460
% Average Annual Increase		
1962-69	27.5	17.0
1967-69	26.0	55.0

[1/] Gasoline consumption is totally for vehicles, but diesel consumption includes 20-30% of other consumption.

Source: Ministry of Commerce and Industry

December 1970

TABLE 6

KOREA

FIRST HIGHWAY PROJECT

Highway Authorities and Agencies

	Expressways (toll)	National Highways	Provincial Highways[1]	City/County Roads
Planning	MOC	MOC	8 Provincial Construction Bureaus (PCB)	City/County Construction Sections (CCS), assisted by PCB
Construction				
Design and supervision	Korea Highway Corporation (KHC)[2]	5 Regional Construction Bureaus (RCB)	PCB	CCS
Financing	MOC/KHC[3]	MOC	Provinces with MOC grants	City/County with Provincial grants
Maintenance				
Executing authority/agency				
Paved	KHC	PCB	PCB	PCB
Unpaved	-	CCS	CCS	CCS
Financing	KHC	MOC and Provinces	Provinces with MOC grants	City/County with Provincial grants

1/ Includes the Special Cities of Seoul and Pusan.

2/ The Seoul-Pusan Expressway was constructed by the Seoul-Pusan Expressway Construction Office (SPECO); KHC was created in January 1969.

3/ KHC has not so far financed any construction.

Sources: Ministry of Construction and BCEOM/NEDECO

December 1970

KOREA

FIRST HIGHWAY PROJECT

Highway User Charges
(million Won)

Revenue	1965	1966	1967	1968	1969	1970	1971 1/
National taxes							
Fuel taxes 2/	2,512	2,887	4,048	9,680	12,791	16,958	20,033
Gasoline tax	(1,456)	(1,840)	(2,687)	(6,796)	(9,365)	(12,181)	(14,358)
Diesel tax	(1,056)	(1,047)	(1,361)	(2,884)	(3,426)	(4,774)	(5,675)
Transportation tax	902	2,421	4,025	5,581	8,387	12,238	12,012
Commodity tax	67	348	500	1,178	2,277	2,619	3,024
Customs duties	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Sub-total	3,481	5,656	8,573	16,439	23,455	31,815	35,069
Local taxes							
Vehicle tax (incl. surcharge) Registration fee) Acquisition tax)	846	1,081	1,555	2,488	3,869	5,602	7,228
	104	181	250	584	881	1,165	1,500
Sub-total	950	1,262	1,805	3,072	4,750	6,767	8,728
Tolls	-	-	-	6	436	N.A.	N.A.
Total	4,431	6,918	10,378	19,517	28,641	40,569	46,912

1/ Budgeted.

2/ Total revenues, not only proportion earmarked for highways.

Sources: Ministry of Construction, Ministry of Finance, and Ministry of Home Affairs

May 1971

TABLE 8

KOREA

FIRST HIGHWAY PROJECT

Expenditures on Roads, 1965-71
(million Won)

Item	1965	1966	1967	1968	1969	1970 1/	1971 2/
Government Expenditures on National Highways							
Administration	49	56	69	105	187	200	299
Construction	800	1,081	1,892	13,387	29,259	23,663	21,596
Maintenance 3/	40	-	165	240	282	298	525
Sub-total	889	1,137	2,126	13,732	29,728	24,161	22,420
Expenditures on 4/ 5/ Provincial and City/County Roads							
Construction and Maintenance	2,180	5,109	7,045	8,873	18,826	19,508	10,900
Total	3,069	6,246	9,171	22,605	48,554	43,669	33,320

1/ Estimated.

2/ Budgeted.

3/ Does not include funds contributed by provinces for the maintenance of national highways.

4/ Maintenance includes some expenditure on national highways but does not include the value of voluntary labor provided for all highways.

5/ Includes Government grants.

Sources: Ministry of Construction and BCEOM/NEDECO

May 1971

KOREA

FIRST HIGHWAY PROJECT

Design Standards for Primary National Highways (Rural)

	Unit	Flat	Rolling	Hilly/ Mountainous[1]	All Areas
Geometric Design Standards					
Design speed	km/h	120	100	70	
Minimum radius of curvature	m	630	390	180	
Maximum gradient	%	4	5	6.5	
Roadway Features					
Width of pavement	m				7.20
Width of shoulders	m				3.00-1.75
Width of right-of-way	m				42 minimum
Structural Design Features					
Axle-load (pavement)	lbs				18,000[2]
Bridge loading	-				DB-18, equivalent to AASHO H20-S16
Bridge widths (over 60-100 m long)[3]	m				10.70

1/ Design speeds and widths may be reduced and gradients increased in mountainous/ alpine terrain, as appropriate to each case.

2/ Pavement designed for the projected number of repetitions of "equivalent 18,000 lb axle-loads".

3/ Depending on traffic volumes.

Sources: Ministry of Construction, BCEOM/NEDECO, and Ingeroute

May 1971

KOREA

FIRST HIGHWAY PROJECT

MOC Field Organization for Maintenance of National Highways:
Program and Implementation Schedule

Program	Implementation Date
A. Pilot Province (Gyeongi-do)	
1. Establish a highway maintenance section in the existing RCB at Seoul	October 1, 1971
2. Establish two highway maintenance field sections at Vijungbu and Suwon under the existing RCB at Seoul, and take over maintenance of all national highways (other than toll roads) in the Gyeongi-do province	January 1, 1972
B. Study of Highway Maintenance by Consultants	
1. Start study	October 1, 1971
2. Submit Phase I Report to Bank covering detailed organization and implementation schedule for setting up nationwide MOC field organization for maintaining national highways	April 1, 1972
3. Determine, in consultation with the Bank, the organization and implementation schedule on the basis of 2 above	June 1, 1972
4. Submit Phase II Report to Bank covering (a) detailed schedules of staff, facilities, equipment and financing required for the nationwide MOC field organization; and (b) proposed five-year program (1974-78) for maintenance of national highways	November 1, 1972
5. Adopt, in consultation with the Bank, a five-year program of highway maintenance on the basis of 4 above	February 1, 1973
C. Nationwide MOC Field Organization for Maintenance of National Highways	
1. Establish, in accordance with the agreed organization and implementation schedule (reference B.3 above), highway maintenance sections under each of the existing RCBs	October 1, 1973
2. Establish, in accordance with the agreed organization and implementation schedule, the highway maintenance and field sections	July 1, 1974
3. Establish, under BPR, regional offices for maintenance of national highways and transfer to these offices from the RCBs the national highway maintenance field sections (reference C.1 above)	July 1, 1975

Source: Ministry of Construction

May 1971

KOREA

FIRST HIGHWAY PROJECT

MOC Field Organization for Maintenance of National Highways:
Estimated Capital and Recurrent Costs of Pilot Project, 1971-73
(million Won)

	1971	1972	1973
Capital Costs			
Mechanical equipment and tools	250	60	-
Offices, stores, workshops, furniture, etc.	55	-	-
Sub-total	305	60	-
Recurrent Costs			
Staff	1	13	13
Maintenance paved roads 1/	1	119	139
Maintenance gravel roads 1/	2	158	158
Sub-total	4	290	310
Total	309	350	310

1/ Includes labor, materials, fuels, equipment operations; does not include equipment depreciation.

Sources: Ministry of Construction and BCEOM/NEDECO

May 1971

KOREA

FIRST HIGHWAY PROJECT

MOC Field Organization for Maintenance of National Highways:
Mechanical Equipment for Pilot Province (Gyeongi-do)

Description	No.	Estimated Cost[1/] (Million Won)
Dump trucks	20	83
Motor graders	6	51
Rollers	5	25
Trucks	9	18
Tractors	2	16
Front end loaders	2	14
Asphalt distributors	2	9
Crushers	2	9
Station wagons	5	5
Small equipment spare parts and tools		50
Total		280

(Equivalent to approximately US$900,000)

1/ C.i.f. landed cost.

Sources: Ministry of Construction and BCEOM/NEDECO

May 1971

KOREA

FIRST HIGHWAY PROJECT

Roads Included for Feasibility Studies (see Map)

	Length (km)
Taegu-Masan	104
Samchok-Pohang	223
Chonan-Changhang	146
Wonju-Taegu	262
Chongju-Jaechon	126
Seoul-Kimchon	253
Wonju-Chongju	55
Mokpo-Sunchon	141
Inchon-Suwon	47
Naju-Shinshiri (Sihinjeongni)	43
Total	1,400

Sources: Ministry of Construction and BCEOM/NEDECO

May 1971

KOREA

FIRST HIGHWAY PROJECT

Estimated Cost of Project

Item	Won (million) Local	Foreign	Total	US$ (million) Local	Foreign	Total	% Foreign Exchange Component
A. Highway Construction (370 km)							
1. Chonju-Kwangju-Yonhwa	4,110	2,740	6,850	13.1	8.7	21.8	40
2. Yonhwa-Sunchon-Chinju-Masan	6,470	4,320	10,790	20.6	13.7	34.3	40
3. Masan-Pusan	3,080	2,060	5,140	9.7	6.6	16.3	40
Sub-total	13,660	9,120	22,780	43.4	29.0	72.4	40
B. Consulting Services:							
1. Supervision of A.	410	630	1,040	1.3	2.0	3.3	60
2. Feasibility studies of about 1,400 km of national highways	250	570	820	0.8	1.8	2.6	70
3. Detailed engineering of Saemal (Wonju)-Kangnung and Mukho-Sokcho (200 km)	190	250	440	0.6	0.8	1.4	60
4. Detailed engineering of about 900 km of highways to be selected from B.2	720	1,010	1,730	2.3	3.2	5.5	60
5. Study of Highway Maintenance	30	130	160	0.1	0.4	0.5	80
Sub-total	1,600	2,590	4,190	5.1	8.2	13.3	
C. Mechanical Equipment for Highway Maintenance in Pilot Province	1/	280	280	1/	0.9	0.9	100
D. Contingency Allowance							
1. On Item A. 20% (a) 10% quantity (b) 10% price	2,680	1,890	4,570	8.5	6.0	14.5	
2. On Items B. and C. 10%	160	280	440	0.5	0.9	1.4	
Sub-total	2,840	2,170	5,010	9.0	6.9	15.9	
Sub-total A.-D.	18,100	14,160	32,260	57.5	45.0	102.5	
E. Refunding of Technical Assistance Credit S4 KO	-	1,100	1,100	-	3.5	3.5	
Total A.-E.	18,100	15,260	33,360	57.5	48.5	106.0	

1/ Small amount for local handling and transport of imported equipment; also possibly a small amount of local manufacture/assembly if domestic suppliers submit successful bids for part of the equipment.

Sources: Ministry of Construction and Ingeroute

May 1971

KOREA

FIRST HIGHWAY PROJECT

Estimated Schedule of Disbursements

IBRD Fiscal Year and Quarter	Cumulative Disbursement at end of Quarter (US$ thousands)
1971/72	
September 30, 1971	3,200
December 31, 1971	3,400
March 31, 1972	5,100
June 30, 1972	7,700
1972/73	
September 30, 1972	10,300
December 31, 1972	13,400
March 31, 1973	17,100
June 30, 1973	21,500
1973/74	
September 30, 1973	26,600
December 31, 1973	32,300
March 31, 1974	38,200
June 30, 1974	43,800
1974/75	
September 30, 1974	49,200
December 31, 1974	52,000
March 31, 1975	53,500
June 30, 1975	54,500

Source: Mission Estimates

May 1971

KOREA

FIRST HIGHWAY PROJECT

Estimated Traffic Volumes on Chonju-Pusan National Primary Highway, 1970-93

Road Sections	Average Annual Daily Traffic							Estimated Traffic Growth (% p.a.)				
	1970		Estimated									
	Actual	Est. Diversion	1974	1978	1984	1988	1993	1970-72	1973-77	1978-82	1983-87	1988-93
Chonju-Yonhwa												
Cars	256	156	387	915	2,386	4,030	6,790	26	24	18	14	11
Buses	184	82	159	308	596	836	1,118	18	16	12	9	6
Trucks	193	130	281	563	1,269	1,997	3,072	22	19	15	12	9
Government 1/	21	18	18	18	18	18	18	0	0	0	0	0
Yonhwa-Masan												
Cars	115	96	238	563	1,407	2,377	4,005	26	24	17	14	11
Buses	80	52	98	172	316	446	596	18	15	11	9	6
Trucks	120	105	219	424	914	1,438	2,212	22	18	14	12	9
Government 1/	5	5	5	5	5	5	5	0	0	0	0	0
Masan-Pusan												
Cars	937	745	1,833	4,196	8,134	8,134	8,134	26	23	18	0	0
Buses	691	444	846	1,532	2,588	2,588	2,588	18	16	14	0	0
Trucks	818	701	1,515	3,038	5,500	5,500	5,500	22	19	16	0	0
Government 1/	88	53	53	53	53	53	53	0	0	0	0	0

1/ Ingeroute has assumed a zero growth rate for this type of traffic. As this is a small proportion of traffic, even significant deviation from this assumption would not appreciably affect the economic evaluation or design standards.

Sources: Ministry of Construction, Ingeroute, and Mission Estimates

December 1970

TABLE 16

KOREA

FIRST HIGHWAY PROJECT

Vehicle Operating Costs on Chonju-Pusan National Primary Highway
(Won per km)

		Chonju-Yonhwa	Yonhwa-Masan	Masan-Pusan
Cars:	Including Passenger Time[1]			
	Existing Road	33	33	26
	New Road	19	20	21
	Saving	14	13	5
	% Saving	42	39	18
	Excluding Passenger Time			
	Existing Road	23	23	17
	New Road	14	14	15
	Saving	9	9	2
	% Saving	39	39	15
Buses:	Including Passenger Time			
	Existing Road	101	100	82
	New Road	56	58	62
	Saving	45	42	20
	% Saving	44	42	24
	Excluding Passenger Time			
	Existing Road	54	53	40
	New Road	31	31	35
	Saving	23	22	5
	% Saving	42	41	15
Trucks:	Existing Road	59	59	43
	New Road	36	36	36
	Saving	23	23	7
	% Saving	39	39	16
Government Vehicles:[2]	Existing Road	52	52	38
	New Road	31	31	32
	Saving	21	21	6
	% Saving	40	40	16

1/ Passenger time savings have been valued at W58 (US$0.18) for car passengers and W29 (US$0.09) for bus passengers.

2/ Approximate weighted average of above types.

Sources: Ingeroute and Mission Estimates

May 1971

KOREA

FIRST HIGHWAY PROJECT

Rates of Return on Chonju-Pusan National Primary Highway
(%)

Assumptions	Chonju-Yonhwa	Yonhwa-Masan	Masan-Pusan	Total
Most likely values of investment, traffic growth and vehicle operating costs, including passenger time	28	22	32	28
Most likely values of investment, traffic growth and vehicle operating costs, excluding passenger time	24	19	23	24
Most likely values of investment and vehicle operating costs, including passenger time, but assuming a 25% reduction in traffic growth rates	21	16	27	23
Most likely values of investment and vehicle operating costs, excluding passenger time, but assuming a 25% reduction in traffic growth rates	18	13	21	18
Conservative values of investment, traffic growth and vehicle operating costs, including passenger time 1/	23	18	26	24
Conservative values of investment, traffic growth and vehicle operating costs, excluding passenger time 1/	20	15	18	19
Optimistic values of investment, traffic growth and vehicle operating costs, including passenger time 2/	33	25	38	32
Optimistic values of investment, traffic growth and vehicle operating costs, excluding passenger time 2/	28	21	30	27

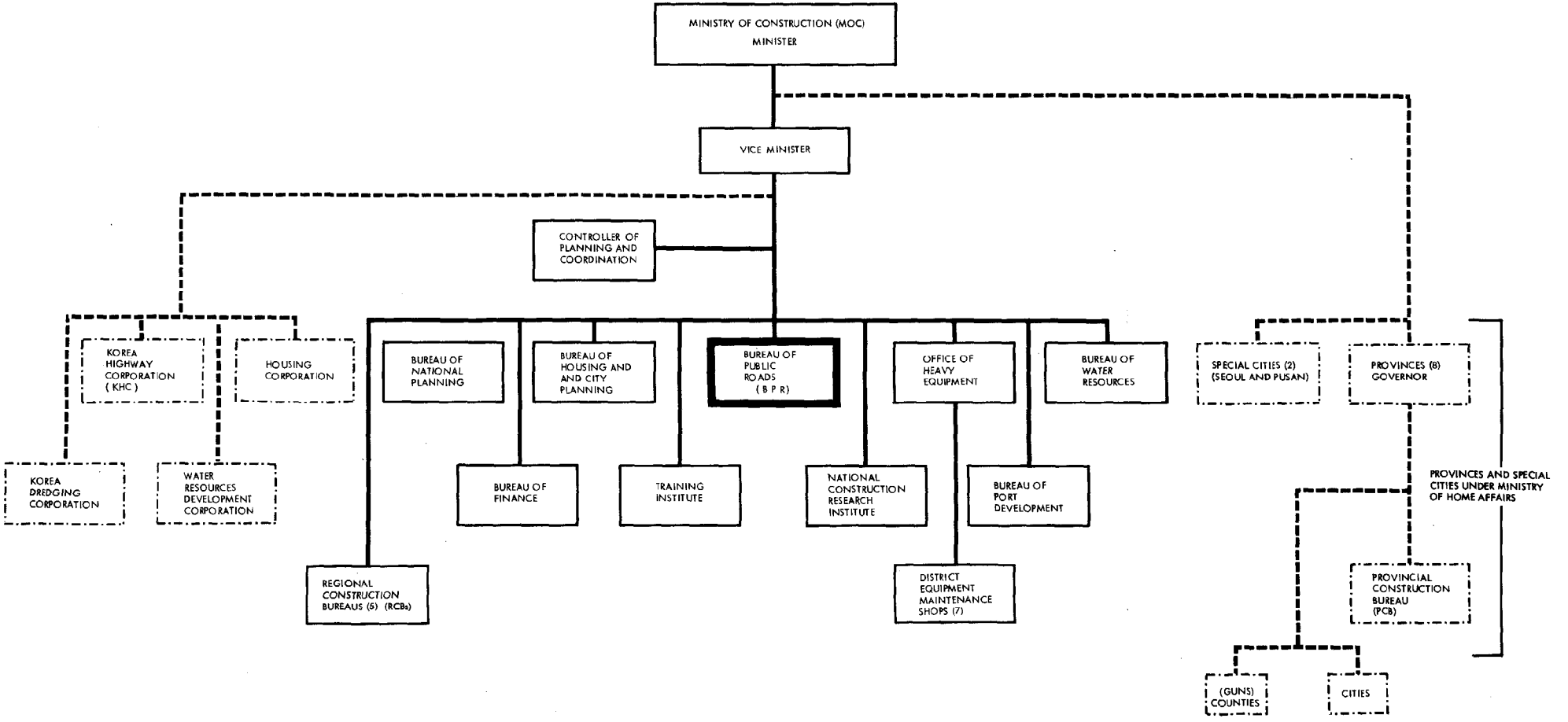
1/ Conservative assumptions are: (i) 10% increase in investment and (ii) 20% decrease in benefits.

2/ Optimistic assumptions are: (i) 10% decrease in investment and (ii) 20% increase in benefits.

Source: Mission Estimates

May 1971

KOREA: FIRST HIGHWAY PROJECT
MINISTRY OF CONSTRUCTION ORGANIZATION



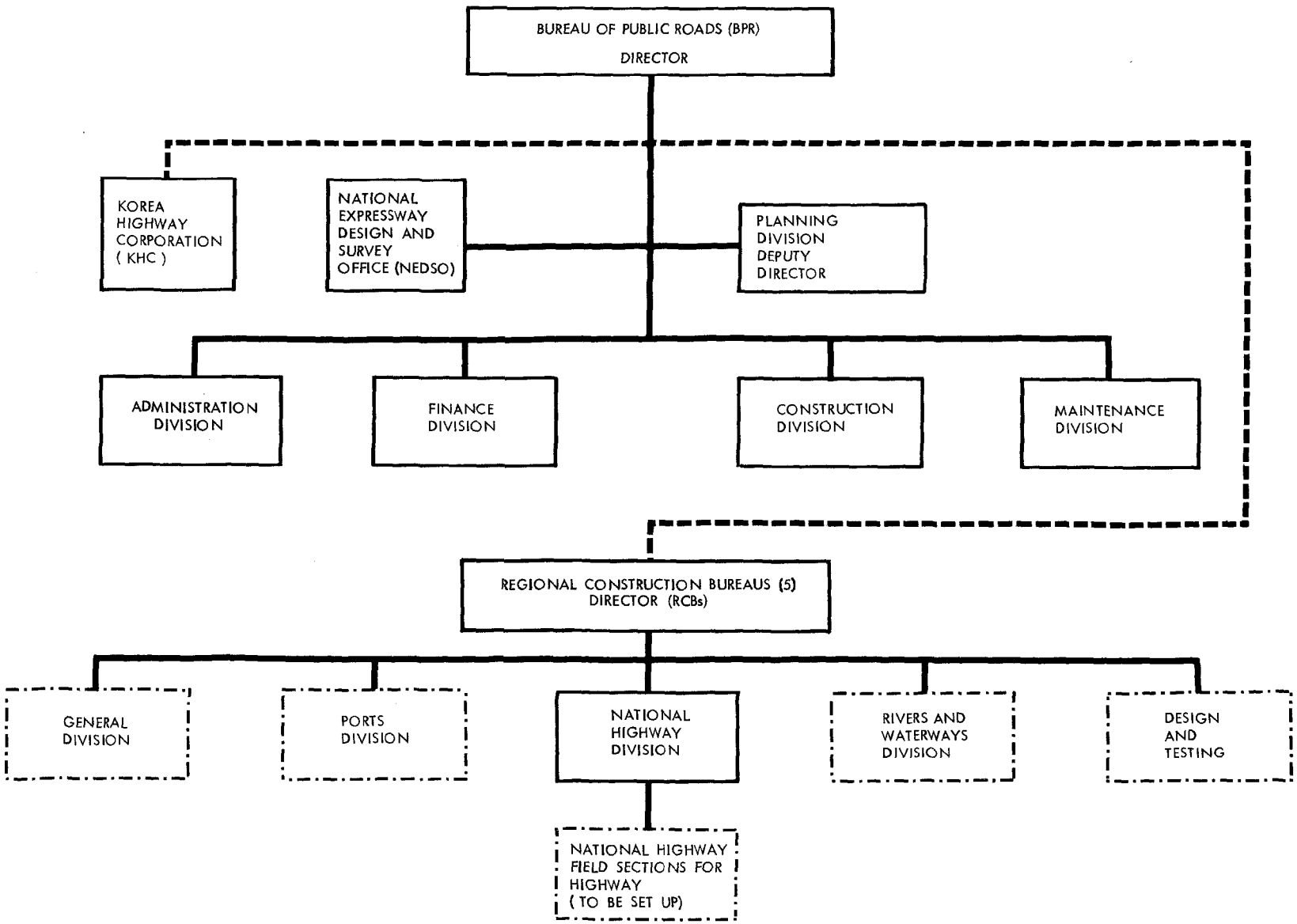
SOURCE: Ministry of Construction
March 1971

IBRD - 5616(R)

CHART 1

KOREA : FIRST HIGHWAY PROJECT

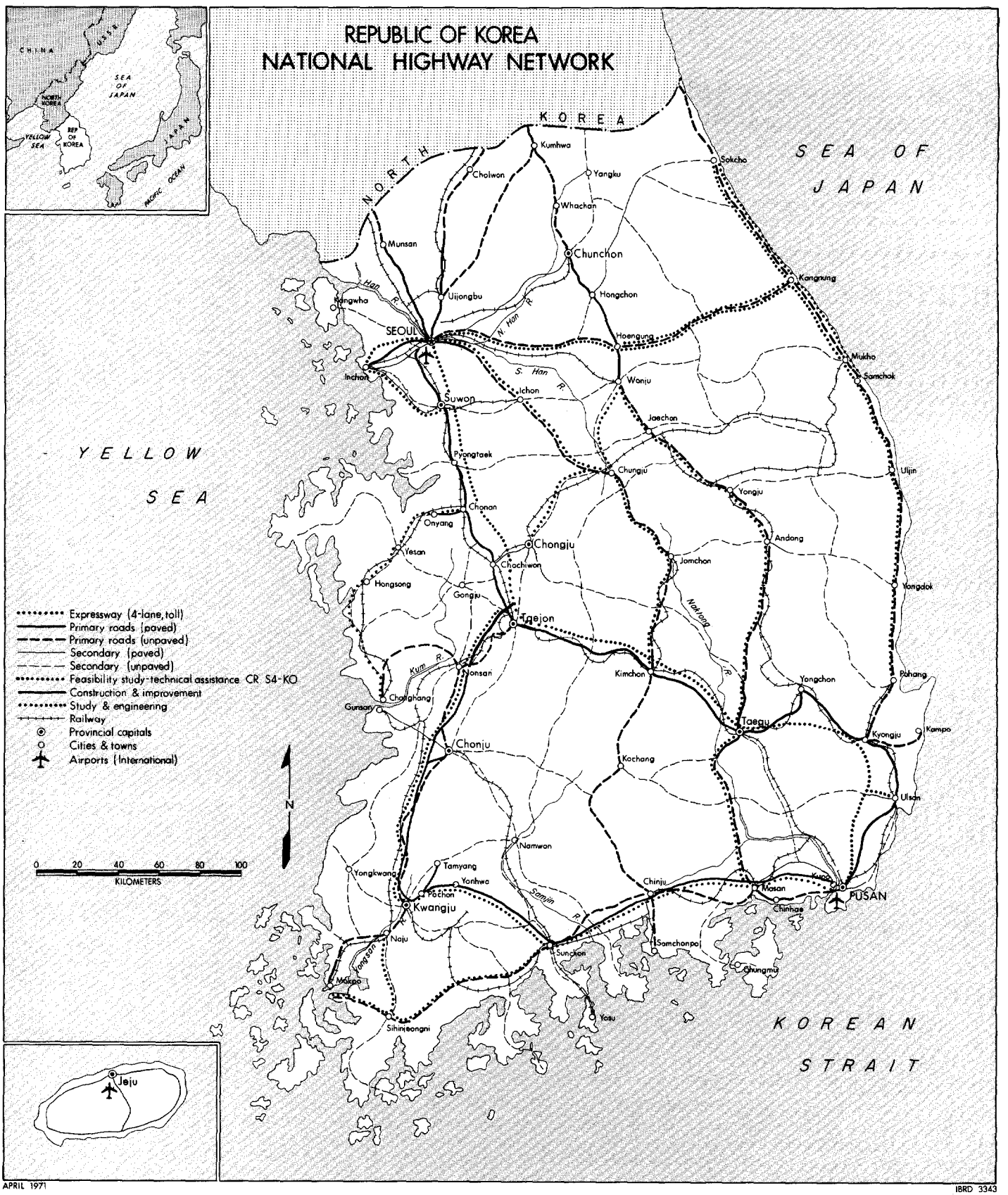
BUREAU OF PUBLIC ROADS ORGANIZATION



SOURCE: Ministry of Construction
March 1971

IBRD - 5615(R)

CHART 2



APRIL 1971

IBRD 3343